

## Development and Evaluation of an Environmental Awareness Android Game

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### Abstract

The main purpose of this project is to develop and evaluate a game application that will help raise awareness about the environment and environmental issues. The researchers came up with this idea to give players the knowledge of what will happen to the environment if it is taken for granted by humans. The app has eight (8) mini-games and some animation videos that the players will enjoy and at the same time, gain knowledgeable information with the trivias/facts that will be provided in the game.

The game was divided into two categories namely, the Quick Game in which the player could choose which of the mini-games to play and the Classic Game which is the normal flow of the game where the mini-games are played randomly. The evaluation instrument used was the user's Evaluation Sheet for Game Design/Animated Video with the criteria of Game Design, Game Script, Graphic Arts, Music and Sound, Quality, Intellectual Component, and Compliance with Project Objectives. The overall mean was interpreted as "Excellent". The evaluation result shows that the game application is a tool for learning and increasing awareness.

**Keywords:** Game Design, Software Evaluation, Environmental Game

### 1. Introduction

In this digital age, mobile phones are used most of the time because of its handiness and convenience. In their mobile phones, people are usually interested in games. Mobile games play an important role in the lives of millions of people worldwide. Many applications like games can be accessed online.

[2] It is a good way to share information and broaden people's knowledge and can help change attitudes and behavior. The game industry is expanding rapidly, and games are developing in sophistication and complexity.

[1] [3] Games are increasingly being used for serious or social purposes in a wide range of fields, including environmental awareness. PARABUKAS is an android game application wherein its main objective is to develop an android application that would raise environmental awareness to the player and at the same time it gives fun, and challenge to the player while engaging them in the game itself. Nowadays, the society seems deeply connected in and around media and portable devices are of common use and affect the way of learning and knowing everything around us. Security in Softwares are to be considered.

[4] [5] This made the proponents push through this project not only to give fun but also to educate the player about the environment. At the end of the project, the proponents expect to:

- Cover both technical and creative aspects of games development.
- Develop expertise through a major- Game Design, Animation or Software Technologies.
- Be prepared for a career in games design, animator, or mobile entertainment developer.



## 2. Methodology

The main focus of PARABUKAS is to raise awareness about the environment and the environmental issues. The mini-games of the game are entitled "TREEfense!" in which the player should defend the trees by tapping the illegal logger. Next, the "SEGREgreat!" wherein which "segre" stands for segregation, the player's knowledge of waste segregation will be tested in the game.

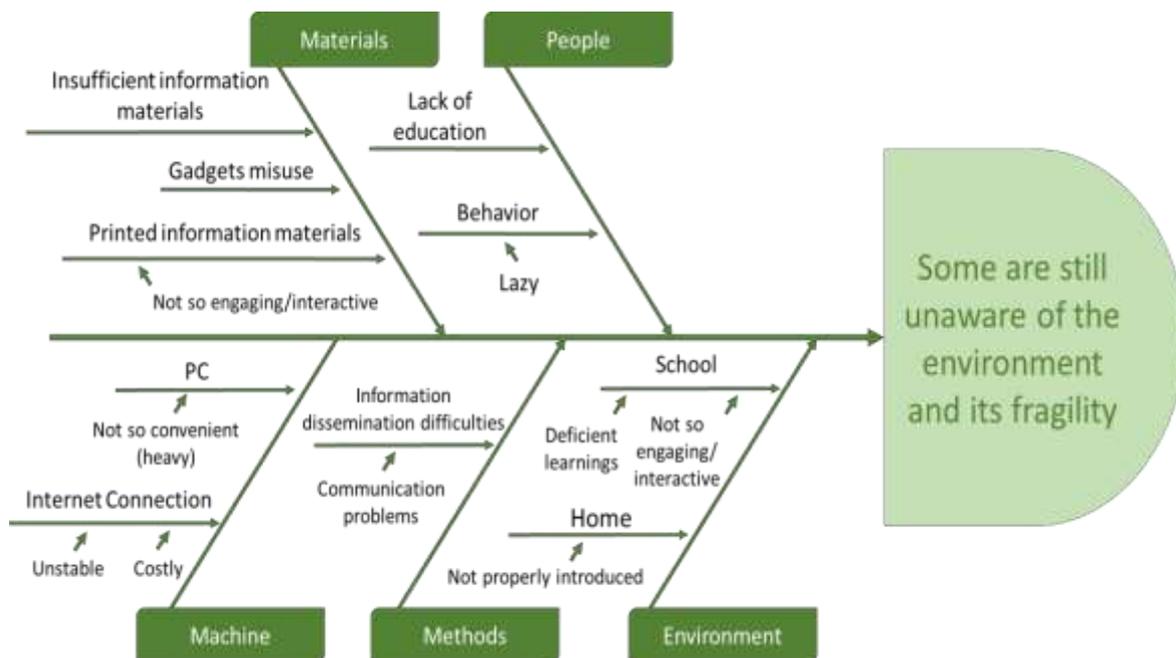
The "pauseCET!" wherein Pause means stop, the player will be directed not to tap the faucet, this game focuses on water conservation. "ENVIRONmend!", wherein the game, the player is tasked to fix the incomplete word "Environment" by tapping the lacking letters. Then, "peaceSSILE!" a game about the weapons' consequences to the environment, the player must stop the missiles from falling by tapping it.

"waySTE!" is a drainage system game wherein at first the pipes' parts are not in correct condition, so the player must then tap the pipes to fix it. Another game is titled, "reMINEder!", a friendly reminder game to the mining industry which imparts a message to stop mining, the objective of this game is to tap the screen as long as the indicator is lined within the green zone.

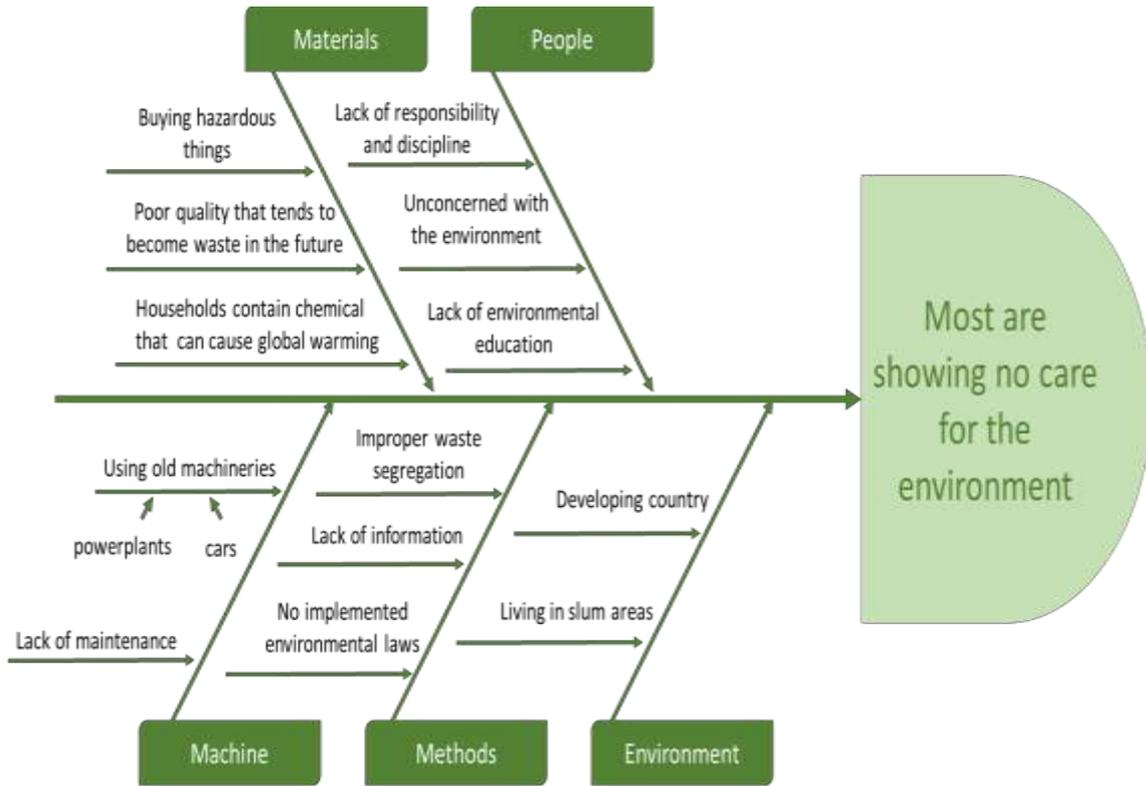
Lastly, "endNERGY!" a game for energy conservation, the player must tap the active unused household appliances. The target of this project are people who have interest in downloading the game from Google Play Store.

### 2.1 Requirements Specifications

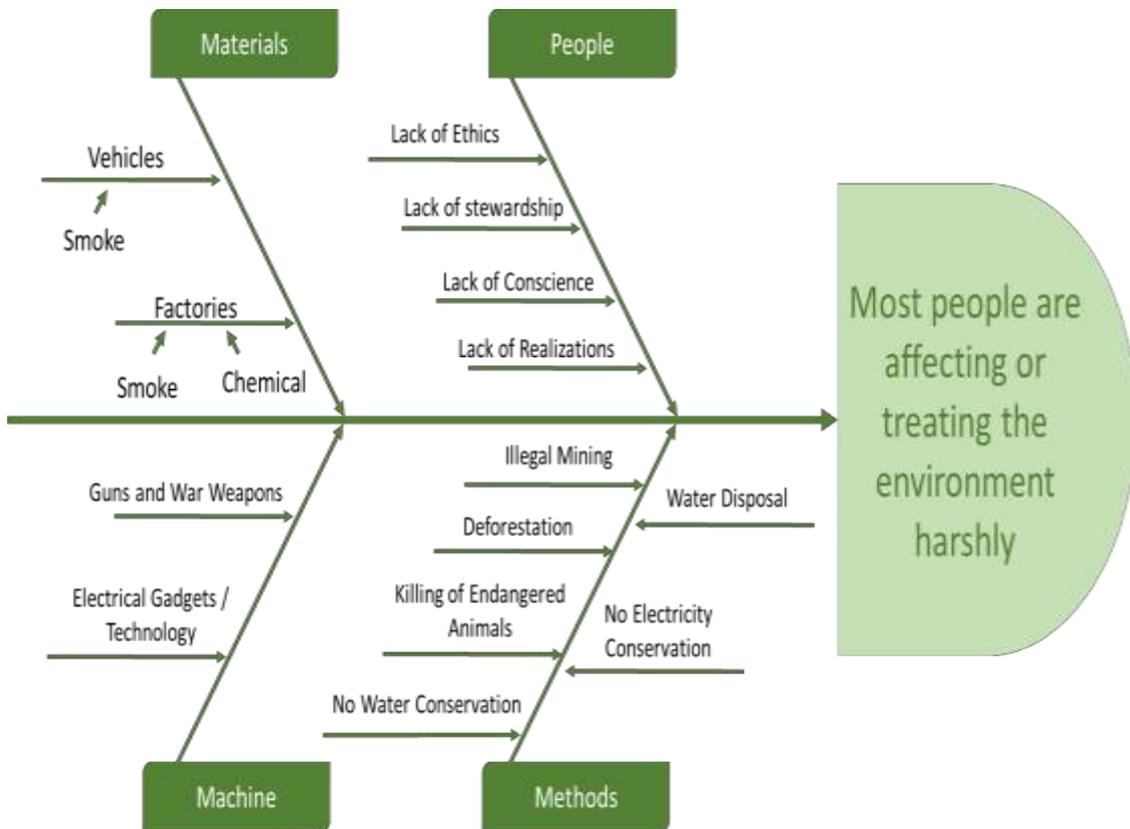
This diagram (Figure 1) shows the factors that affect the first issue where some people are still unaware of the environment and its fragility. First, the information materials are identified insufficient and not interactive. Next, the machines such as PCs, and Internet connection are not convenient, unstable, costly, and gadgets are used in a different aspect instead of learning which leads to difficulties in information dissemination. Lastly, environmental awareness is not properly introduced at home and learning in schools are not interactive and deficient. As a result, it affects people's behavior that leads to lack of education.



**Figure 1.** Some People are still unaware of the environment and its fragility.



**Figure 2.** Most people show no care for the environment

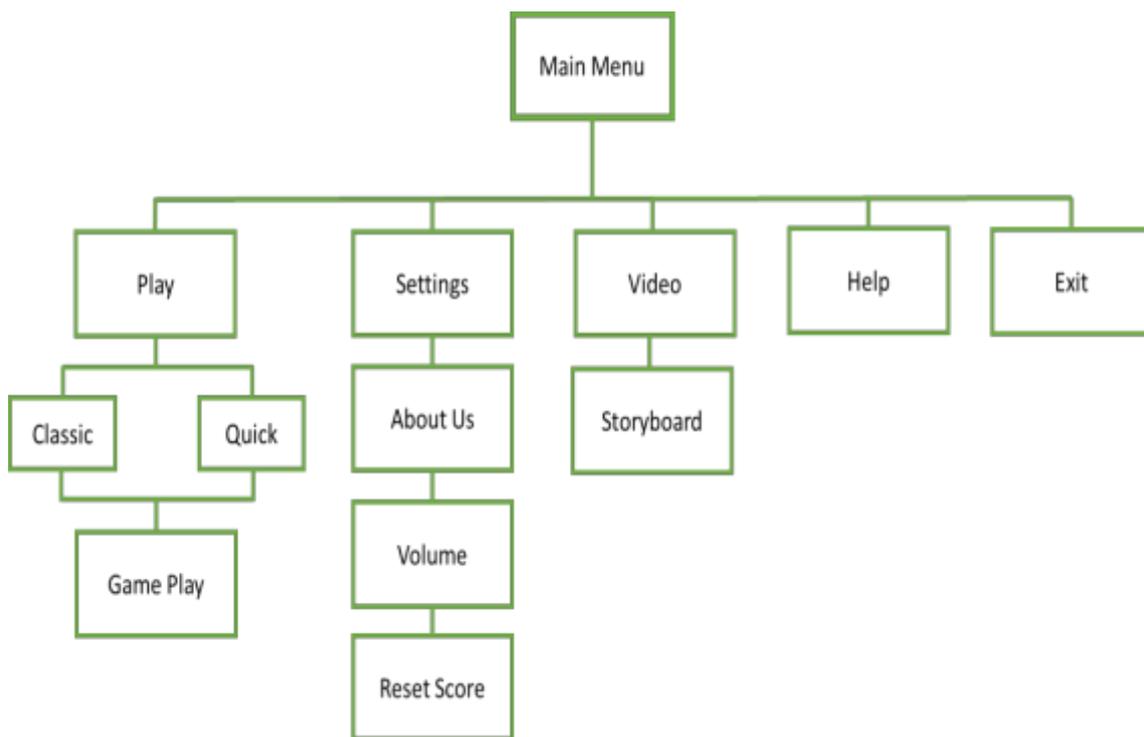


**Figure 3.** Most people are affecting or treating the environment harshly

In this diagram (Figure 3), factors are shown as evidence that most people are showing no care for the environment. Buying hazardous things that are of poor or substandard quality and that contain chemicals that contribute to global warming. Those old, and rusty machineries do not work properly because of lack of maintenance. In return, they produce greenhouse gases. In addition, the buy and throw method, improper waste segregation only add waste in the surroundings. And lastly, the people who lack responsibility, self-discipline, and lack of environmental education due to poverty. In this diagram (Figure 3), the researchers had identified four factors that cause the issue that most people are affecting or treating the environment harshly. First, the materials that we use which include vehicles and factories where smokes and chemicals contribute to pollution. Next, machines such as guns, war weapons and gadgets that destruct the environment intentionally or unintentionally. Then, in methods which are abusive activities that we unconsciously do that destroy the environment without noticing it. And lastly, people who lack ethics, stewardship, conscience, and realization of our deeds. [11]

**2.1.1 Functional Decomposition**

Figure 4 shows the functional decomposition chart of the application. First in the chart is the Main Menu of the game and under it are *Play*, *Settings*, *Short Animation* and *Exit*. Under *Play* it has provided mini-games are provided such as *SEGREgreat!*, *TREEfense!*, *PAUSEcet!*, *ENVIRONmend!*, *peaceSSILE!*, *waySTE!*, *reMINERder!*, and *endNERGY!* and this followed by gameplay of each mini-games.



**Figure 4.** Functional Decomposition Chart of PARABUKAS

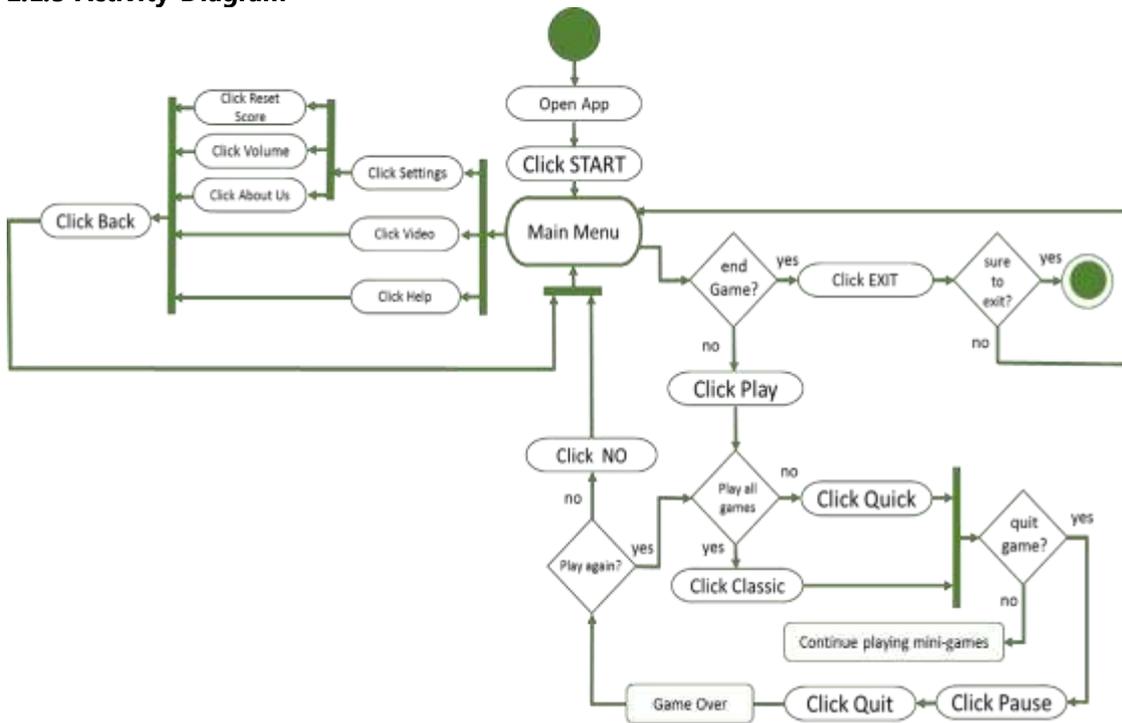
**2.1.2 Technical Feasibility**

For the hardware, the researchers used a laptop which has a Windows 10 [7] operating system and as for the software, the researchers used Adobe Creative Cloud products for the development of the game [8]. Adobe CC 2015 was updated to include support for Windows 10 which makes them compatible. The researchers also used Unity 5.6.0f3 for building the application and it requires an android minimum version support updated to 4.1 (Jellybean) [9] and up. For testing and running the application, the researchers used



mobile devices that also has an android operating system version 4.1 and up. [10]

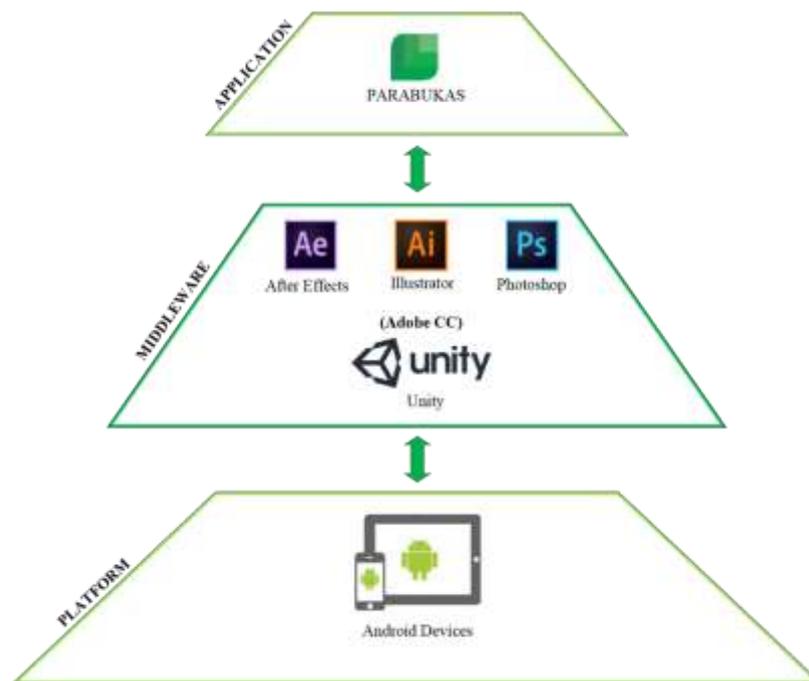
### 2.1.3 Activity Diagram



**Figure 5.** Activity Diagram for PARABUKAS

Figure 5 is an Activity Diagram of PARABUKAS that shows the flow of one activity to another activity. The player must click or tap the button in order to go on a particular scene.

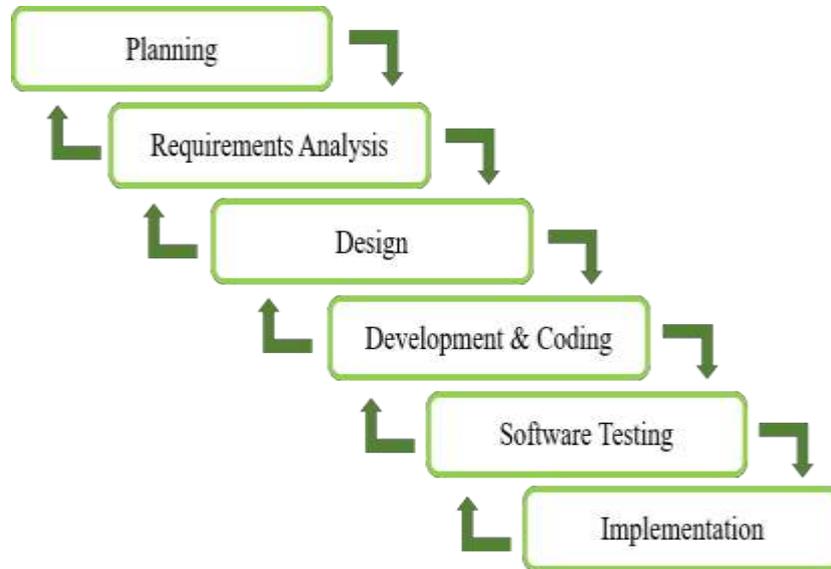
### 2.1.4 System Architecture



**Figure 6.** System Architecture of PARABUKAS

Figure 6 shows the application (PARABUKAS), the middleware used, and the platform where PARABUKAS can run. The middleware used were Unity for coding, the Adobe Creative Cloud Softwares; After Effects, Illustrator, and Photoshop for creating the graphics. It only runs on Android devices.

Development



**Figure 7.** Agile Method

The figure shows how the project was developed using the agile development model. It had undergone the stages of initiation and planning, analysis, design, development, and testing. The process is iterative in some phases until it is implemented and completed.

**2.2 Testing**

**Table 1.** Testing Procedure

Type of Test	Description	Frequency
Unit Testing	Testing functionality of every individual unit of the application.	Every 5 days
Integration Testing	Testing the functionality and compatibility of the application as a whole.	Every 1 week
Load Testing	Determining the capacity and performance of the game using different platforms and specs.	Every 2 weeks
User Acceptance Testing	Testing the acceptability of the application.	

### 3. Results and Discussion

PARABUKAS was developed to be a 2D mobile game application for android. The game was designed with the features of environment, mechanics, and game play of each environmental game. The development tools that were used for this project are the Unity 3D for the game development, Adobe Photoshop, Adobe After effects, and Illustrator for the animation and graphics. The system had undergone testing through conformance and compatibility testing. The result was used to improve the system’s overall performance.

The evaluation was conducted to achieve the system’s acceptance of the user based from the Android Core App Quality standards using the criteria such as Visual Design, User Interaction, Functionality, Performance, and Stability.

The evaluation instrument used was based from the Android game application and was participated by ten (10) mobile users. According to the evaluation result of the pre- survey, almost 30% of the participants are not aware about the environment and environmental issues while 10% are unsure of their answer which meant that PARABUKAS can be played and provide insights to increase people’s awareness about the environment and environmental issues.

Upon finishing the game, the proponents had conducted another survey which is the post-survey that has been participated by the same respondents during the pre-survey. The results of post-survey have garnered a 95% said yes compared to 30% of the pre- survey which meant that the awareness of the people was raised by 65% with the help of the PARABUKAS game application.

The proponents have successfully achieved the project’s objective through the evaluation/survey conducted that was participated by thirty (30) respondents wherein the result showed “Excellent”. The result of the evaluation proves that PARABUKAS could be a great tool for increasing the awareness and learning of its player.

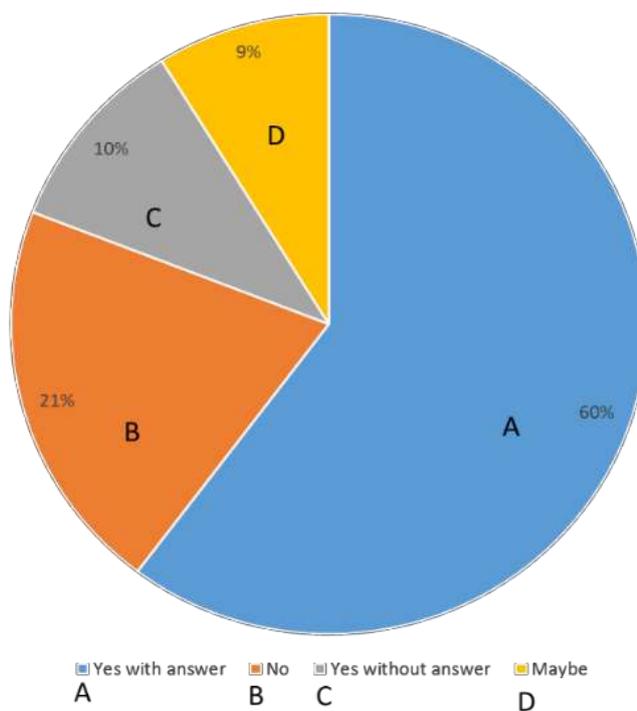
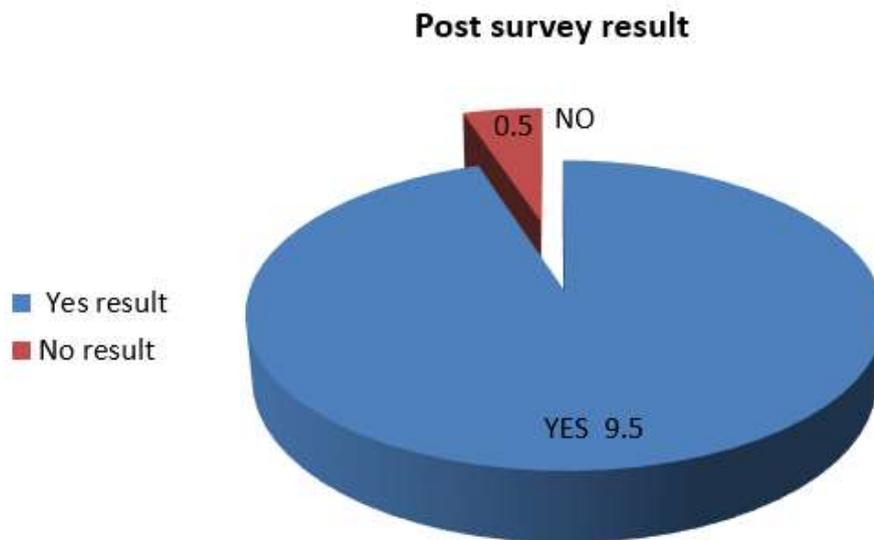


Figure 8. Pre-survey Result



**Figure 9.** Post-survey Result

<b>CRITERIA FOR COMPUTER GAME/ANIMATED VIDEO</b>	Mean	Interpretati
<b>A. ON GAME DESIGN</b>		
1. The theme of the game/video support positive behavior.	4.87	Excellent
2. The instructions on how to play the game presented clearly and easy to follow.	4.60	Excellent
3. Background is appropriate. There's balance of colors that's pleasing to the eyes.	4.70	Excellent
4. Artworks blend with background and compliments with the theme.	4.70	Excellent
5. Graphics and sounds are well done.	4.63	Excellent
6. The objectives of the game/video can be grasped from the environment presented.	4.90	Excellent
7. The rules of the play are given clearly. If forces one to organized and make plans.	4.40	Excellent
8. The game is easy to learn and play.	4.60	Excellent
<b>B. ON THE SCRIPT</b>		
1. The script describes the action of flow of game.	4.43	Excellent
2. The dialogue of the characters in the game/video is appropriate for the intended audience, and free from obscene or vulgar language.	4.55	Excellent
3. There is representation and story. It touches the player's emotion.	4.52	Excellent
<b>C. ON GRAPHIC ARTS</b>		
1. The artwork of the game/video includes sophisticated graphics.	4.53	Excellent
2. The package design supports the story.	4.67	Excellent

3. Text layouts blends well with graphics, music and sound.	4.53	Excellent
<b>D. ON MUSIC AND SOUND</b>		
1. Choice of music is appropriate for the theme and story of the game/video.	4.40	Excellent
2. There are special effects to compliment the design.	4.40	Excellent
<b>E. ON QUALITY ASSURANCE</b>		
1. A user interface provides control for the game enabling the user to play the game.	4.77	Excellent
2. The game uses GUIs mouse, keyboard, or special hardware to enable users to communicate with computer by manipulating what they see on the computer screen.	4.47	Excellent
3. There is scorekeeping accomplished through the use of simple numeric variables.	4.83	Excellent
4. There is graphics engine or physics engine that performs math and render objects for video games or simulation.	4.37	Excellent
5. There is timekeeping mechanism.	4.43	Excellent
<b>F. ON THE INTELLECTUAL COMPONENT</b>		
1. There is promotion of values in the game/video.	4.83	Excellent
2. Playing the game/video is fun. It gives player enjoyment, pleasure and recreational	4.60	Excellent
3. The game/video has goals and wins states. The player given motivation and egogratiication.	4.63	Excellent
4. The game/video has outcomes and information feedback. It gives player learning.	4.83	Excellent
5. The game is adaptive. On continuous playing, the player becomes familiar with it.	4.70	Excellent
6. There is interaction with the game. It gives player social groups and keeps him/her doing.	4.33	Excellent
7. There is conflict/ competition/opposition/problem-solving. It sparks the player's creativity.	4.47	Excellent
8. The game encourage the player to persist, even in the face of difficulty of failure.	4.70	Excellent
9. The game supports continued and repeated play.	4.77	Excellent
10. There are different levels of play. It entices the player to discover and explore.	4.73	Excellent
<b>G. IN COMPLIANCE WITH THE PROJECT OBJECTIVES</b>		
1. The game/video satisfies its specifications & attains the project of objectives.	4.73	Excellent
2. The intended functions are performed with precisions	4.70	Excellent

1-1.8 – Poor 1.81- 2.6 - Fair 2.61 – 3.4 Good 3.41- 4.2 Very Good 4.21 – 5 Excellent

**Table 2.** Evaluation tool with results



The evaluation respondents and the developers suggested additional features for the improvement of the project.

- Leader board, for saving list of the names of the player who got the high scores.
- Addition of mini-games for more entertainment.
- Increase difficulty for a more challenging game.
- Graphics Improvement
- Player's profile

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